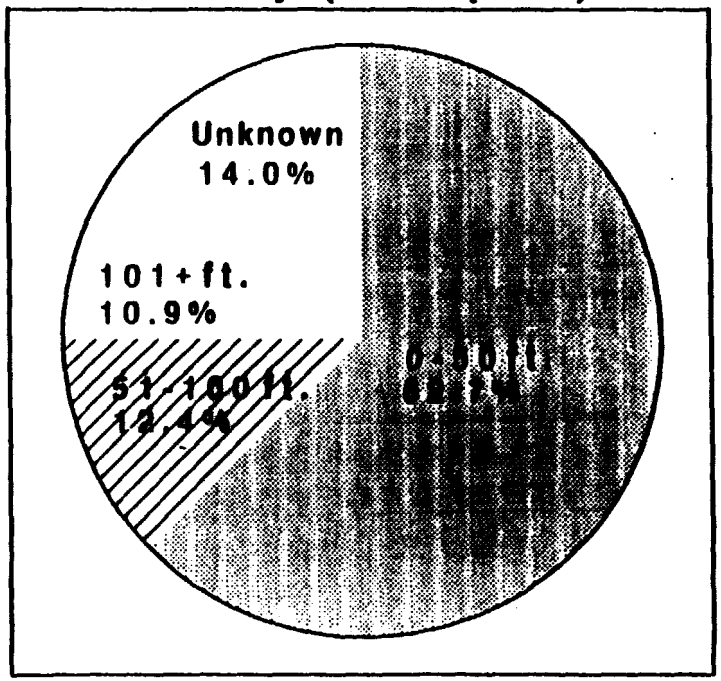
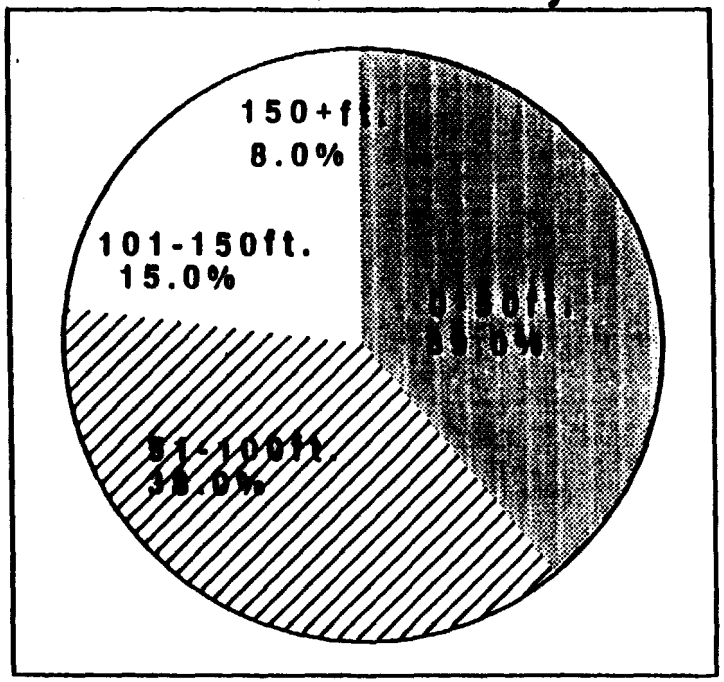
1971 U.S. Army Wire Strike Study (Helicopters)



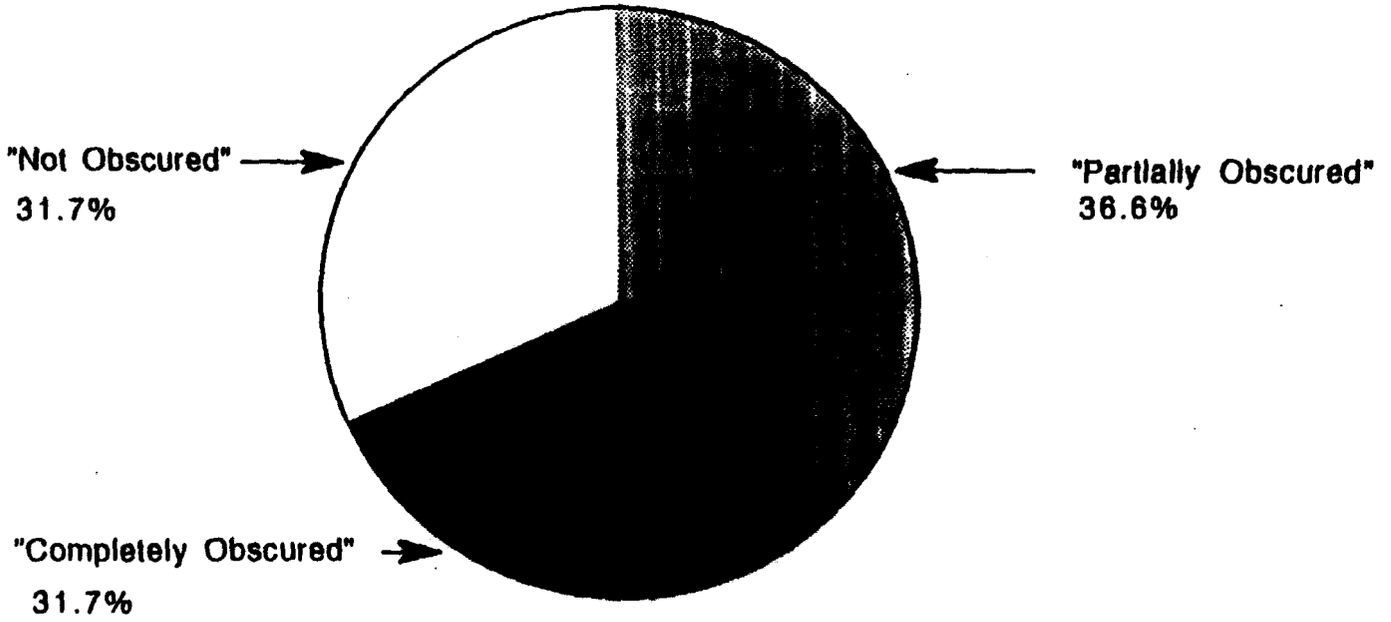
1986 U.S. Army Helicopter Wire Strike Study



WHAT WE KNOW

Wire Strike Conditions

Wire Conspicuity



SOURCE: 1986 U.S. Army Memorandum Study

WHAT WE KNOW

F.A.A. Obstruction Marking Requirements

F.A.A. Advisory Guidelines

- FAA Advisory Circular (AC) 70/7460-1H recommends a more encompassing criteria than FAR 77: "Any object that exceeds an overall height of 200 feet above ground level or exceeds any obstruction standard contained in FAR 77 should normally be marked and/or lighted."

- FAA Advisory Circular (AC) 70/7460-1H also provides technical specifications for marking powerlines and/or illuminating support structures.

WHAT WE KNOW

Low Altitude Flying

"Navigable Airspace" Concept

- Federal Aviation Act of 1958 defines "navigable airspace" as:

  "airspace above the minimum altitudes of flight prescribed by regulations issued under this Act, and shall include airspace needed to insure safety in takeoff and landing of aircraft"

- Federal Aviation Regulation 91.119 (Minimum Safe Altitudes: General) reguires that:

  "Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

  (a) Anywhere. An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

  (b) Over Congested Areas. Over any congested area of a city, town or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizon radius of 2,000 feet of the aircraft.

WHAT WE KNOW

Helicopter Low Level Operations

Low Level Corridors

- Helicopter low level corridors are not published, have evolved through necessity, common usage and local custom.

- Corridors often reflect unique terrain or geographical features such as mountain passes or airspace between/below controlled areas.

- Corridors frequently parallel strong surface features (freeways, rivers, railroad tracks, etc.), pass through a topographic depression and/or minimize exposure while flying over rough or difficult terrain.

WHAT DO WE NEED TO KNOW FOR AN EFFECTIVE MARKING PROGRAM?

Prior Studies Indicate "Conspicuity/Visibility" of Wires as Important Criteria

- Number, height, size, span and condition of wires
- Detectability of wires at various distances, altitudes and angles
- Difficulty of detecting support structures due to location, size, shape, color or surrounding vegetation
- Depicting of wires on aeronautical charts or other navigational maps

WHAT SHOULD WE DO TO DEVELOP A MODEL WIRE STRIKE PREVENTION PROGRAM?

Conceptual Overview

- Incorporate expertize of all participants into wire identification & marking prioritization process
  - Jointly develop effective wire marking criteria for use in evaluating candidate sites
    - Initiate a unified and coordinated process to evaluate existing and future wires for marking
      - Establish prioritization program for marking designated wires
        - Establish a regulatory mechanism for implementation oversight and program review
          - Expand refined program into other states/regions

WHAT WE WANT TO KNOW

EFFECTIVE MARKING CRITERIA

Conspicuity/Visibility of Wires

- Number, height, size, span and condition of wires
- Detectability of wires at various distances, altitudes and angles
- Difficulty of detecting support structures due to location, size, shape, color or surrounding vegetation
- Depicting of wires on aeronautical charts or other navigational maps

Attachment IV

Evaluation Materials and Tutorial

Used During Two-Year Demonstration Project

3. This site was observed from the:

- ☐ A. Air only
- ☐ B. Ground only
- ☐ C. Air & ground

4. The "setting" of this site is:

- ☐ A. On/near an airport (within 3 s.m.)
- ☐ B. Road/highway/freeway
- ☐ C. River
- ☐ D. Canyon
- ☐ E. Canal
- ☐ F. Lake
- ☐ G. Ag. Field
- ☐ H. City/populated area
- ☐ I. Hill/mountains
- ☐ J. Other _____

5. In the past 12 months, I have visited or observed this site:

- ☐ A. Never
- ☐ B. 1-5 separate occasions
- ☐ C. 5-10 separate occasions
- ☐ D. 10+ separate occasions

6. My position is:

- ☐ A. Field Technician/Specialist
- ☐ B. Engineer
- ☐ C. Supervisor/Manager
- ☐ D. Other _____

WIRE-MARKING ASSESSMENT PACKAGE

WIRE-MARKING ASSESSMENT CRITERIA AND EVALUATION MATRIX

TUTORIAL FOR EVALUATORS

TABLE 1

VISIBILITY/CONSPICUITY OF WIRES & SUPPORTING STRUCTURES

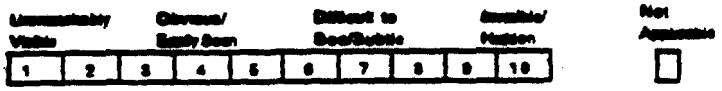
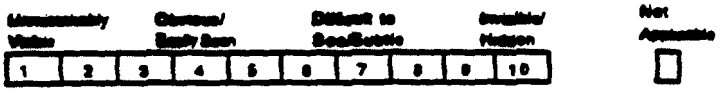
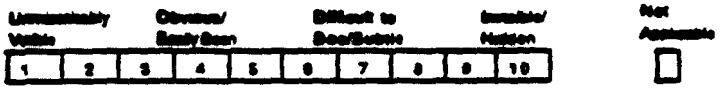
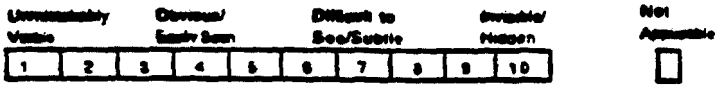
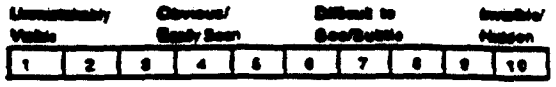
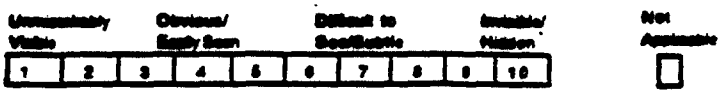
Evaluation Criteria Questions	Considerations and Scoring Format
1. Is the transmission line recognizable due to the number of wires installed?	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft. 
2. Does the diameter of the wires facilitate recognition?	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft. 
3. Are the wires recognizable from both directions at a distance of 1 mile?	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft. 
4. Does the wire's height above ground produce a contrast with background vegetation, sky or the horizon?	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft. 
5. Have the wires/static line oxidized or corroded to where they blend in with the background?	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft. 

TABLE 1 (continued)

VISIBILITY/CONSPICUITY OF WIRES & SUPPORTING STRUCTURES

Evaluation Criteria Questions	Considerations and Scoring Format
12. Are there right-of-way roads parallel to and in proximity of the transmission line that enhance recognition of the wires or support structures? (If not applicable, leave score at right blank.)	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft. 
13. Are there activities close by the line that might be a distraction to a low flying pilot?	Score between 1 and 10 based on your perception of the wire's visibility from a low-flying aircraft.  Note: Do not rate the visibility of the "activities", but how those "activities" impact the overall visibility of the line. PG&E April 1994

Sum of scores for questions 1-13: ___ ÷ # of questions scored = ___ (overall score)

TABLE 2 (continued)

LIKELIHOOD OF LOW-LEVEL AIRCRAFT ACTIVITY

Evaluation Criteria Questions	Considerations and Scoring Format
6. Do airplanes or helicopters frequent the area for unique reasons (sample water, load or unload passengers/cargo, etc.)?	Score between 1 and 10 based on your perception o the "foreseeability" of low-level aircraft activity i the area. Remote Improbable Occasional Probable Frequently 1 2 3 4 5 6 7 8 9 10 Not Appl
7. Have pilots previously complained of "near misses" or "close encounters" with the wires and/or supporting structures?	Score between 1 and 10 based on your perception o the "foreseeability" of low-level aircraft activity i the area. Remote Improbable Occasional Probable Frequently 1 2 3 4 5 6 7 8 9 10 Not Appl
8. Do local weather conditions encourage aircraft to routinely operate low-level in the area?	Score between 1 and 10 based on your perception of the "foreseeability" of low-level aircraft activity in the area. Remote Improbable Occasional Probable Frequently 1 2 3 4 5 6 7 8 9 10 Not Appl
9. Do airspace restrictions or overhead flight routes compel aircraft to operate at low altitudes near the wires?	Score between 1 and 10 based on your perception of the "foreseeability" of low-level aircraft activity in the area. Remote Improbable Occasional Probable Frequently 1 2 3 4 5 6 7 8 9 10 Not Appl
10. Are there other factors, conditions or considerations which would justify a conclusion that aircraft will likely operate at low-level near this structure or wire span?	Score between 1 and 10 based on your perception of the "foreseeability" of low-level aircraft activity in the area. Remote Improbable Occasional Probable Frequently 1 2 3 4 5 6 7 8 9 10 Not Appl

Sum of scores for questions 1-10: ___ ÷ # of questions scored = ___ (overall scor

TUTORIAL

I. BACKGROUND

The wire-strike risk assessment methodology presented herein is the product of a two (2) year cooperative effort between California's major utilities, various governmental agencies, and a broad cross-section of representatives from the aviation community. This initiative was formally announced on July 22, 1992, when the Helicopter Association International (HAI) sponsored a "kick-off" meeting to identify "wire-strike" issues and a format for consensus building.

As an outcome of this initial meeting, two (2) task forces or working groups were formed, each consisting of representatives from the utilities, pilot groups, and governmental agencies responsible for promoting aviation safety. One working group was assigned the task of developing recommendations for a pilot education/awareness program relating to overhead wires. The second working group was tasked to evaluate potential criteria for determining if existing or future overhead wires should be marked, notwithstanding that federal or state regulations/guidelines may not require the marking of the wires under considerations.

The wire-strike assessment methodology described herein and supporting tutorial material provides those engaged in wire-marking decisions with the working-

II. VISIBILITY/COMSPICUITY OF WIRES AND SUPPORTING STRUCTURES

A. Overview

Table 1, titled "VISIBILITY/CONSPICUITY OF WIRES AND SUPPORTING STRUCTURES," sets forth a series of thirteen (13) Evaluation Criteria Questions relating to transmission line detectability from a low-flying aircraft at the same elevation as the wires. Each question focuses on a different factor that may either aid or hinder the wire's visibility by the pilot of a low-flying aircraft.

B. Scoring the "Wire's Visibility"

Following each question, the evaluator is asked to "score" the wire's visibility on a scale ranging from 1-10 where the number "1" represents a wire or wires that are "Unmistakably Visible" and the number "10" represents an "Invisibly Hidden" wire or wires. One or more of the thirteen (13) Evaluation Criteria Questions presented in Table 1 may not be applicable at a particular site. When this occurs, the evaluator can "check" the "Not Applicable" block and disregard the use of a numerical score for that question.

After considering and scoring each of the Evaluation Criteria Questions in Table 1, the evaluator must determine an OVERALL wire visibility score. The OVERALL score is calculated by summing the numerical scores for questions

special attention should be given to the diameter of the wire in the highest position.

Question No. 3

This question focuses on whether one or more of the wires are visible at a distance of one (1) statute mile from the transmission line WHEN viewed from the highest wire's elevation (±200 feet) AND from a point that represents the aircraft's most likely flight path towards the transmission line, i.e., along a freeway corridor or from a prominent location (airport, canyon pass, etc.). It is not necessary that the transmission line be visible for 1 mile in all directions. Instead, it is more important to estimate the aircraft's most likely approach path(s), ground track and altitude, towards the transmission line and then determine if the transmission line is visible from one (1) mile in the direction of the anticipated approach path.

Question No. 4

When viewed from a height approximating the highest wire, is there a contrast between the wire(s) being evaluated and the background? In general, the lower a transmission line, the more likely that a contrast with the background will not exist.

structures as potential aeronautical obstructions (usually alternating orange and white markings) does the existing painting scheme adequately highlight the presence of a transmission line and its location/height.

Question No. 9

Are the transmission line's supporting structures adjacent the site visible from a distance of approximately one (1) statute mile when viewed from approximately the same elevation as the highest wire AND from a direction where aircraft are likely to approach. As noted previously, it is not essential or necessary that the supporting structures be recognizable from one (1) mile in all directions, but rather that the evaluator specifically consider the structure's visibility when viewed from the aircraft's most likely approach path(s).

Question No. 10

Sometimes the spacing pattern or alignment of the supporting structures can facilitate recognition of transmission lines. This is most likely to occur when the intervals between supporting structures are relatively close and spaced at a uniform distance, or when the transmission lines' alignment is near perpendicular to the aircraft's expected route of flight and several uniformly positioned support structures are located and visible left and right of the site.

III. FORESEEABILITY OF LOW-LEVEL AIRCRAFT ACTIVITY

A. Overview

Table 2, titled "FORESEEABILITY OF LOW-LEVEL AIRCRAFT ACTIVITY," sets forth a series of Ten (10) Evaluation Criteria Questions relating to the likelihood or foreseeability of low-level aircraft activity at the site. Each Evaluation Criteria Question presented in Table 2 describes a different consideration or factor that may either increase or decrease the foreseeability of low-level aircraft frequenting the site at an altitude comparable to the wire's elevation.

B. Scoring the "Foreseeability of Low-Level Aircraft Activity"

Following each question, the evaluator is asked to "score" the "foreseeability of low-level aircraft activity" on a scale ranging from 1-10 where the number "1" represents the foreseeability of low-level aircraft activity is "Remote" and the number "10" represents the likelihood of "Frequent" aircraft activity. One or more of the ten (10) Evaluation Criteria Questions presented in Table 2 may not be applicable at a particular site. When this occurs, the evaluator should "check" the "Not Applicable" block and disregard the use of a numerical score for that question.

background information. If the line was impacted by an aircraft experiencing an in-flight emergency (i.e., engine-failure) or if the evaluator remains uncertain if a prior contact has occurred, do not designate a score at the right.

Question No. 2

The reason for this question is that low-flying aircraft will frequently navigate by reference to major transportation corridors (freeways, railroads, etc.) on the surface. Not every intersection of a transmission line and a surface corridor is likely to attract low-level aircraft activity. However, major surface transportation corridors that link adjacent cities or penetrate natural barriers such as wilderness areas, mountains, deserts, waterways, etc. are likely to be used as a navigational reference by pilots. When a transmission line intersects a surface corridor of this type, the likelihood of aircraft activation proximity to the wires is considerably greater.

Question No. 3

The significance of this question is two-fold:

a) the volume of aircraft in the airspace increases as the distance to/from an airport or heliport is reduced. Reference to an aeronautical chart will depict the presence of landing areas (airports or heliports) near the site/span being evaluated and thereby indicate the likelihood of airport-related operations.

FAA FLIGHT STANDARDS DISTRICT OFFICES IN CALIFORNIA

Fresno	(209)487-5306
Long Beach	(210)426-7134
Los Angeles	(310)215-2150
Oakland	(510)273-7155
Riverside	(714)276-6701
Sacramento	(916)551-1721
San Diego	(619)557-5281
San Francisco	(415)876-2771
San Jose	(408)291-7681
Van Nuys	(818)904-6291

Question No. 5

The military has designated certain areas and routes for low-level flight training. Normally, these military training areas and routes are described in detail within DOD "Flight Information Publications" to include boundaries, track widths, altitudes, etc. The various military services maintain a senior aviation officer at FAA's Western-Pacific Regional Headquarters in Lawndale, California. These individuals may be contacted [(310)297-1161] and queried regarding the presence of military low-level routes or training areas near the site/span being evaluated.

Question No. 6

Aircraft may frequent an area in a low-level flight mode for several unique mission, to include:

military combat training or "feeding" a nearby airport with a high volume of arrivals and departures. "Airspace restrictions" near busy airports, military bases and military ranges frequently require pilots to fly at lower than normal altitudes.

Unless the evaluator is knowledgeable of local air traffic procedures or familiar with data depicted on a relevant aeronautical chart, it may be useful to consult with a local pilot and/or other aviation expert. Consultation with a Cal Trans or FAA pilot is also recommended.

Question No. 10

Self-explanatory. After consulting with pilots or FAA/Cal Trans personnel, the evaluator may become aware of special activities (airshows, balloon festivals, etc.) that are likely to attract low flying aircraft near the site.

Attachment VI

Distribution of Pilot Education Materials

for California Wire Strike Avoidance Program

as of December 12, 1995

Recipient	Pamphlets	Videos
FAA-Western Pacific Region	3,000	25
Helicopter Association International	1,000	10
Public Use Airports	1,600	9
California Aviation Organizations	4,000	16

Planned Distribution

Recipient	Pamphlets	Videos
Public Use Airports	6,400	30
California Aviation Organizations	500	30
CalTrans Aeronautics Program	1,500	5
FAA Western Pacific Region (second distribution)	2,000	
Total current and planned	**20,000**	**125**

Attachment VIII

Methodology for Initiating and Appealing Decisions on Wire Marking
(Two-Year Demonstration Project)